

186  
Shares

93

Pro-tip: Increasing the surface area the acetone contacts will increase the strength of the joint. This can be done by incorporating [interlocking joints](#) into the design.

### Pros

- + Acetone will not alter the surface color of the print as much as other glues
- + Once dried, the joint will exhibit the properties of ABS, making further finishing simpler and uniform.

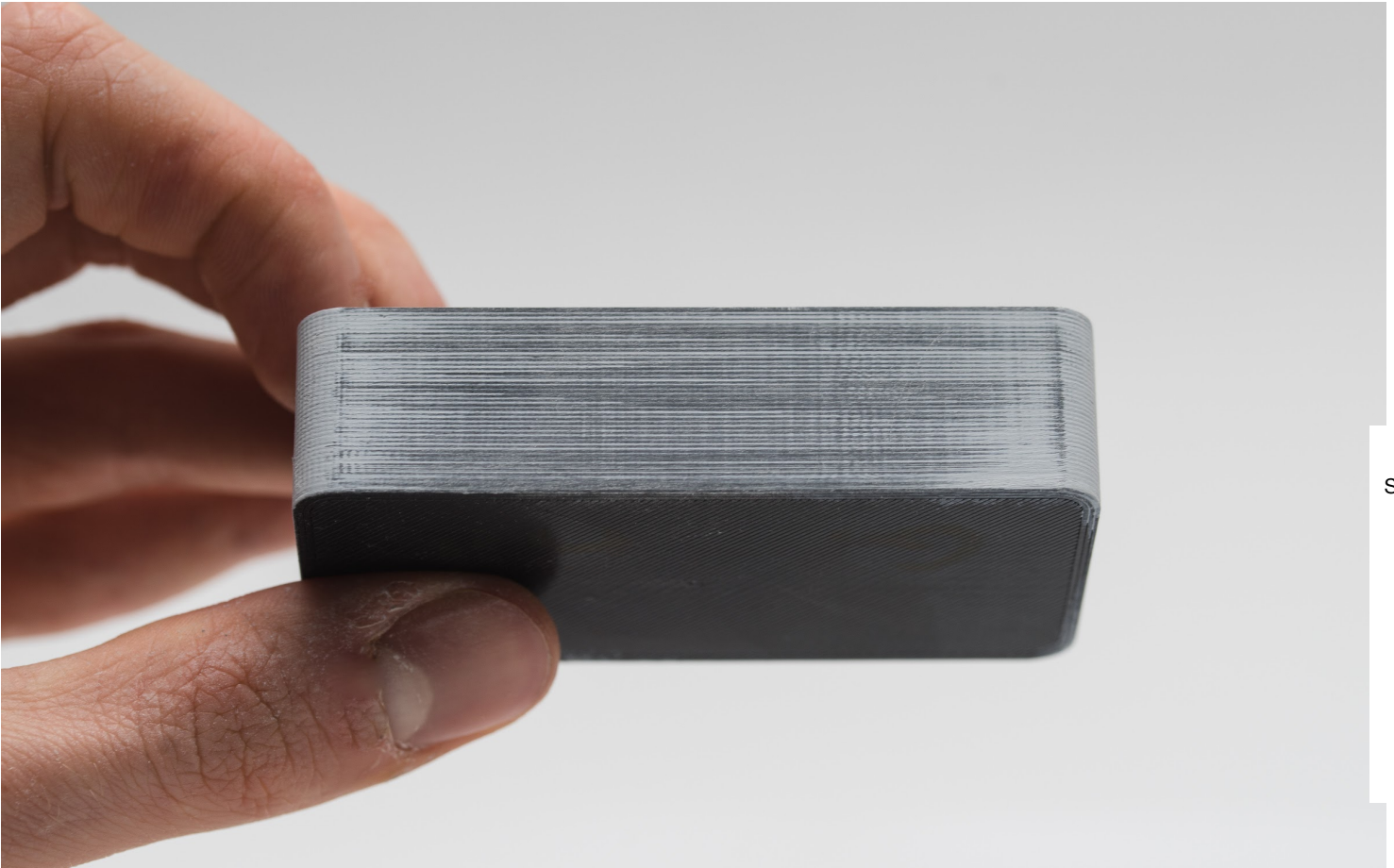
### Cons

- The joint formed by “welding” ABS pieces together with acetone is not as strong as a single piece print.
- Excess use of acetone can aggressively dissolve the part, and negatively impact the resulting finish and tolerances.

Finish	★ ★ ☆ ☆ ☆
Tolerances	★ ★ ☆ ☆ ☆
Speed	★ ★ ★ ★ ★



# Gap filling



186  
Shares

93

A black ABS print coated with gap filler then sanded

## Tool kit

- Epoxy resin (only for small voids)
- Autobody filler (for large voids and joining)
- ABS filament & acetone (only for small voids and ABS prints)

**Process:** After sanding a print, or dissolving soluble supports, it is not uncommon for gaps to emerge on the print. During printing, gaps are formed when layers are incomplete due to toolpath constraints and are often inevitable. Small gaps and voids can easily be filled with epoxy (like XTC-3D), and may not require additional processing. Large gaps, or hollows left from joining a multi-print assembly, can be successfully filled with autobody filler which will require additional sanding once dry. Autobody filler makes an excellent filler, and can easily be sanded and painted once fully cured. It is also very strong, and will not weaken the plastic in the surrounding area; conversely, pieces joined with auto body filler or filled voids tend to be stronger than the native plastic.



Gaps in an ABS print can also be filled by creating a slurry of ABS filament and acetone, which chemically reacts with the ABS print and seeps into any voids in the surface. A ratio of 1 part ABS to 2 parts acetone is recommended, and will not significantly impact the surface finish around the gap if applied properly.

Pro-tip: If gaps are apparent in the print before sanding, fill the spaces with Bond-O or epoxy then sand once dry. This will greatly reduce the total amount of time required to achieve a smooth surface.

Pros

- + Epoxies are easily sanded and primed, making an excellent painting surface.
- + An ABS slurry will be the same color as the print as long as the same filament is used, so there will be no surface discolorations.

Cons

- Autobody filler, or other polyester epoxy, will dry opaquely, resulting in discolored patches on the print.
- Requires additional sanding to achieve a uniform finish.
- Can impact overall accuracy of the the print if sanding is done too aggressively and too much material is removed.

186  
Shares

93

Finish	★ ★ ☆ ☆ ☆
Tolerances	★ ★ ★ ☆ ☆
Speed	★ ★ ★ ☆ ☆
Suitable for	All FDM thermoplastics

Polishing

Tool kit

- Plastic polishing compound
- 2000 grit sandpaper
- Tack cloth



**Process:** After sanding a print, a plastic polish can be applied to give standard thermoplastics, like ABS and PLA, a mirror-like surface finish. Once the print is sanded up to 2000-grit, wipe excess dust off the print with a tack cloth then clean the print in warm water bath with a toothbrush. Allow the print to dry fully, and buff using a buffing wheel or by hand with a microfibre cloth and plastic polishing compound, such as Blue Rouge. Blue Rogue is a type of jeweller’s polish, designed specifically for plastic and synthetics and produces a long-lasting surface shine. Other plastic polishes, such as those for vehicle headlights, work as well but some may include chemicals that can damage the print material.

Pro-tip: Attach a buffing wheel to a variable speed Dremel (or another rotary tool, like a power drill) for polishing small prints. A bench grinder fitted with a buffing wheel can be used for larger more robust prints, but ensure the print does not stay in one place for too long. This can cause the plastic to melt, due to friction.

186

Shares

Pros

- + Polishes the print without the use of any solvents that can warp the print and alter tolerances.
- + Produces a mirror-like finish if properly sanded and polished, which mimics injection molded plastics.
- + Plastic polish and cleaner is highly economical making this method very cost effective for the quality of the finish.

Cons

- Print must be sanded thoroughly before polishing if a mirror-like finish is desired, which can impact tolerances.
- Primer/paint may not adhere to the surface after polishing.

Finish	★★★★★
Tolerances	★★★☆☆
Speed	★★☆☆☆
Suitable for	All FDM thermoplastics







186  
Shares

93

A grey PLA FDM print spray painted black

## Tool kit

- Tack cloth
- Toothbrush
- 150, 220, 400 and 600 grit sandpaper
- Aerosol plastic primer
- Topcoat paint
- Buffing sticks
- Polishing paper
- Masking tape (only if multiple colors are to be used)
- Nitrile gloves & appropriate mask

**Process:** Once the print is properly sanded (only need to go up to 600 grit for painting), the print can be primed. Priming should be done in two coats, using an aerosol primer. An aerosol primer designed for model painting will provide even coverage, and be thin enough to ensure details of the print are not obscured before painting begins. Thick primer, such as what can be purchased at a hardware store, may clump and require significant sanding. Spray the first coat in short quick strokes, approximately 15 - 20 cm away from the part, to avoid pooling of the primer. Allow the



Once priming is complete, painting can begin. Painting can be done with artist acrylic paints and brushes, but the use of an airbrush or aerosol can will provide a smoother surface finish. Spray paint from a hardware store is thicker in viscosity, and more difficult to control, so paints designed specifically for model painting should be used. The primed surface should be buffed and polished (buffing and polishing sticks used by nail salons can be purchased online, and work perfectly for this application) then cleaned using a tack cloth. Paint the model using very light coats; the first few layers will look translucent. Once the paint forms an opaque layer (generally after 2-4 layers), allow the model to sit for 30 minutes so the paint can set. Gently polish the paint layer with the nail sticks, and follow this process for each desired color (polishing between every layer of paint).

Sections of the model can be masked with painter’s tape to preserve the undercoat color if desired. Once all paint layers are complete, remove the masks and polish the paint using polishing paper. Polishing paper, such as 3M’s or Zona’s, can be purchased in different grits and is a relatively new product. It can be purchased as a pack from many online retailers and gives paint, as well as top-coats, a shine that can otherwise not be easily achieved. Apply 1-2 layers of a topcoat to protect the paint, and allow to dry fully. The topcoat should be chosen in accordance with the recommendations of the manufacturer of the paint used. Incompatible topcoat and paint layers can ruin the paint job, so it is very important compatibility is assured here.

Pro-tip: When using aerosol paint, do not shake the can! The goal is to mix the pigment or primer without shaking up the propellant, which will result in bubbles in the spray. Instead, swirl the can for 2-3 minutes; the mixing bead should roll like a marble instead of rattling.

- Pros
- + Produces professional results with attention to detail and some practice.

+ Allows for complete flexibility of the visual appearance of the final product, independent of the material/color the object was originally printed in.

- Cons
- Paint and primer add bulk to the model, which will alter tolerances and can cause issues if the piece is part of an assembly.

– Acquiring high quality aerosol paint or an airbrush can increase cost.

Finish	★★★★★
Tolerances	★★★☆☆
Speed	★☆☆☆☆



# Vapor smoothing



186  
Shares

93

A smoothed black ABS hemi-sphere print

## Tool kit

- Tack cloth
- Solvent-safe sealable container
- Solvent
- Paper towels
- Aluminum foil (or other solvent-proof material)
- Face mask & chemical-resistant gloves

**Process:** Line the chosen container with paper towels along the bottom, and up the sidewalls if possible. It is critical that the vapor will not compromise the chamber itself, and the chamber can be sealed. Glass and metal containers are recommended. Pour in enough solvent to dampen, but not soak, the paper towels; this should also help the towels adhere to the sidewalls of the container. Acetone is well-known for its abilities to smooth ABS. For PLA, smoothing is possible with different



solvents (THF or MEK work decently) but it is generally more difficult to get a smoothed surface when compared to ABS. When working with any solvent, please check the safety regulations on the chemical and always use appropriate safety precautions. A small “raft” of aluminum foil, or other solvent proof material, should be placed in the middle of the paper towel lined container. Place the print on the raft (with whatever side has been chosen as the bottom resting on the raft), and close the lid of the container. Vapor polishing will take a variable amount of time, so check the print periodically. Heat can be used to increase the speed the polishing occurs at, but care must be taken to prevent the buildup of potentially explosive vapor.

When removing the print from the chamber, try to avoid touching the print at all by leaving the print on the raft, and removing both from the container. Any points where the print has been contacted will have surface imperfections, as the outer shell will be semi-dissolved. Allow the print to fully off-gas any remaining solvent before handling.

**NOTE: Many aerosolized and/or atomized solvents are flammable/explosive, and solvent vapor can be harmful to human health. Take extreme care if heating solvents, and always smooth prints/store solvent in a well-ventilated space.**

186  
Shares

Pros

93

- + Smooths many small blemishes and diminishes the layer lines present in a print without any additional work.
- + Produces a very smooth “shell” around the exterior of the print.
- + Very quick, and can be done with commonly sourced materials.

Cons

- Will not “heal” gaps or fully mask layer height.
- Smoothing process “dissolves” the outer shell of the print and therefore this has a heavy impact on tolerances.
- Negatively impacts the strength of the print due to alterations in the properties of the print material.

Finish	★★★★☆
Tolerances	★★☆☆☆
Speed	★★★★☆☆
Suitable for	ABS (sometimes PLA)





## Tool kit

- Solvent-safe container
- Solvent
- Eye hook or small screw
- Heavy gauge sculpting or landscaping wire
- Drying rod or rack
- Face mask & chemical-resistant gloves

**Process:** Ensure that the container to be used is wide enough and deep enough to accommodate the print and the solvent. Fill the container with an appropriate amount of solvent, being careful to minimize any splashing. As with vapor smoothing, acetone should be used for dipping ABS, and MEK or THF can be used to dip PLA. PLA is fairly resistant to solvent smoothing so it may take several attempts to achieve the desired result. Prepare the print for dipping by screwing an eye hook or small screw into an inconspicuous surface of the print. Loop the wire through the eye of the hook, or around the screw, so that the print can be lowered into the bath using the wire. If the wire is too thin of a gauge, it will not be able to counteract the buoyancy of the print and make proper dipping very difficult.

186  
Shares

93

Once the print is prepped, quickly submerge the entire object in the solvent for no more than a few seconds using the wire. Remove the print and hook the wire over a drying rod or rack to allow the solvent to fully evaporate from the surface. The print can be gently shaken after removal to facilitate drying, and ensure no solvent pools in recesses on the surface.

Pro-tip: If once dry, the print has an opaque white-ish color, it can be suspended over the solvent bath for some time to allow the evaporating solvent vapor to slightly dissolve the surface. This will restore the print's color and ensure a shiny outer layer.

## Pros

- + Smooths the print surface much quicker than vapor polishing.
- + Produces much less vapor than other methods of solvent polishing, which reduces the safety risks.

## Cons

- Very aggressively smooths the surface of the print, so tolerances will not be maintained.
- Too long of a dip can result in complete deformation of the print, and significant alteration to material properties.



Finish	★★★★☆
Tolerances	★☆☆☆☆
Speed	★★★★☆
Suitable for	ABS (sometimes PLA)

## Epoxy coating



186  
Shares

93

A black ABS print showing half coated with epoxy and half unprocessed

### Tool kit

- 2-part epoxy resin (such as XTC-3D)
- Foam brush applicator
- Mixing container
- 1000 grit or higher sandpaper

